UNIVERSITY OF MUMBAI

A DISSERTATION REPORT ON

"AUTOMATED ATTENDANCE SYSTEM USING FACIAL RECOGNITION"

SUBMITTED IN PARTIAL FULFILMENT FOR

THE REQUIREMENTS OF THE DEGREE OF

BACHELOR OF ENGINEERING

IN

COMPUTER ENGINEERING

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2019-20

DECLARATION

I declare that this written submission represents my ideas in my own words and where others' ideas or words have been included, I have adequately cited and referenced the original sources. I also declare that I have adhered to all principles of academic honesty and integrity and have not misrepresented or fabricated or falsified any idea/data/fact/source in my submission. I understand that any violation of the above will be cause for disciplinary action by the Institute and can also evoke penal action from the sources which have thus not been properly cited or from whom proper permission has not been taken when needed.

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Place: Shelu

PROJECT REPORT APPROVAL FOR B. E.

This project report entitled **Automated Attendance System Using Facial Recognition** by **Shubham Patil, Amit Pawar, Kaustubh Rai** is approved for the degree of **Bachelor of Computer Engineering.**

Examiners

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Place: Shelu

CERTIFICATE

This is to certify that the project entitled **"Automated Attendance System Using Facial Recognition"** is a bonafide work of **"Shubham Patil" (31),"Amit Pawar" (32), "Kaustubh Rai" (33**) submitted to the University of Mumbai in partial fulfilment of the requirement for the award of The Degree of **"Undergraduate"** in **"Bachelor Of Computer Engineering".**

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LIST OF ABBREVATIONS

SR. NO.	ABBREVATIONS	DESCRIPTION
1	PCA	Principle Component Analysis
2	CNN	Convolutional Neural Network
3	RFID	Radio-Frequency Identification
4	LBP	Local Binary Patterns algorithm

ABSTRACT

Facial recognition technologies have undergone large-scale upgrades and with the new human based facial recognition algorithm named as 'Haar-cascade' [5] which is used with the three classifiers that are skin classifier, mouth classifier & eyes classifier [5]. This proposed system works in real-time as automated attendance system which marks the attendance of employees in an organization. The proposed system uses the algorithm of 'Haar-cascade' [5] with three classifiers implemented using python's 'Open-CV library' [5] and this system uses Principle Component Analysis [PCA] [1] in order to maintain the accuracy of the facial detection. The conventional methods practised in most of the organizations are by calling names or signing on papers, which is highly time-consuming and insecure. This work presents the automated attendance system for convenience and data reliability. This proposed system requires less hardware support also the processing time is also less in compare to other conventional system of signing papers, Radio Frequency Identification [RFID] [2] and biometrics [4] which proves this system to be more efficient for organization to use it in real time application.

***Keywords**:* Open-CV; Computer Vision; CNN; PCA; LBP; human face detection; Haar-like features; face skin hue histogram match; eyes detection; mouth detection; cascade classifier

CHAPTER 1
INTRODUCTION

INTRODUCTION

1.1 OVERVIEW

Attendance automation has become one of the most important needs in educational institutions and work places across the world, since it saves time and accurate too. Face recognition system needs least human cooperation and is viable too. Humans have been using physical characteristics such as face, voice, gait, etc. to recognize each other for thousands of years. With new advances in technology, biometrics has become an emerging technology for recognizing individuals using their biological traits. Now, biometrics is becoming part of day to day life, where in a person is recognized by his/her personal biological characteristics. Examples of different Biometric systems include Fingerprint recognition, Face recognition, Iris recognition, Retina recognition, Hand geometry, Voice recognition, Signature recognition, among others. Face recognition, in particular has received a considerable attention in recent years both from the industry and the research community.

This project presents the development and implementation of Smart Attendance System. Our system is designed in such a way that it manages the employee attendance record in a very efficient manner & time saving pattern that the employee doesn't require to fill the attendance sheet or put a thumb for biometric way or scanning Radio Frequency Identification [RFID][6] cards instead the Automated Attendance System concerns about the employee efforts and doesn't disturb his work and secretly captures the record of his/her presence at the time of employee visiting towards gate and exiting the gate and the record is stored into the database and which contributes hassle free and costless attendance of employee. This cost-saving and time-saving system results a huge profit for organization due to its efficiency.

1.2 AIM AND OBJECTIVE

Our attempt is to develop and implement a Smart Attendance System for organization in hassle free manner just by facial detection using Haar-cascade algorithm [1] with classifier based on skin hue histogram matching, eyes detection and mouth detection. The organization has to just place our Automated Attendance System in the entry gate and exit gate of the working area of the employees. Whenever the employee will just pass through the gate and automatically our system will capture his face while during entry period and exit period and it will store that record into the database. Our system comprises of one camera which will be used for capturing the face of the employee and with the help of Haar-cascade algorithm and three skin, mouth, face classifiers implemented in to the code will match the identity and update the database using the computer vision and machine learning software library known as Open-CV[3]. The proposed model can be used not only for attendance system in organization but also in all sectors of day to day life where attendance plays a major role, with some modification this Automated Attendance System can be used as criminal face detection for identifying criminal at transport and public zones and make public alert.

1.3 PROBLEM STATEMENT

Computerized time and participation frameworks require utilization of equipment, for example, electronic tags, magnetic stripe cards, barcode badges, biometrics, and touch screens instead of paper sheets are used for mainly now-a-days for attendance. In these techniques, students touch or swipe card to give their identification. The given data is recorded and consequently transferred to a PC for handling. By using these systems, we can utilize the time and reduces the errors. This project proposes the face recognition based attendance system. This project is used authenticate the valid person using the face recognition. The project represents a proper authentication and flexibility.
This project is made with the help of Haar-cascade algorithm.

1.4 PROBLEM SOLUTION

This method could also be extended for use in examination halls to curb cases of impersonation as the system will be able to single out the imposters who won’t have been captured during the enrolment process. Applications of face recognition are widely spreading in areas such as criminal identification, security systems, image and film processing. The system could also find applications in all authorized access facilities.

1.5 SCOPE OF THE PROJECT

We are setting up to design a system comprising of two modules. The first module (face detector) is a module component, which is basically a camera application that captures student's faces and stores them in a file using computer vision face detection algorithms and face extraction techniques. The second module is a desktop application that does face recognition of the captured images (faces) in the file, marks the students register and then stores the results in a database for future analysis.

CHAPTER 2
LITERATURE REVIEW

LITERATURE REVIEW

Title of paper	Technologies Used	Results	Limitations
Attendance Management Using Facial Recognition	Principle Component Analysis (PCA)	The system has higher accuracy and less processing speed, and requires least hardware components.	System requires continuous power-supply, and has difficulty to maintain database.
Design of Intelligent Classroom Attendance System Based on Face Recognition	AlexNet Convolutional Neural Network combined with RFID	The System improves the AlexNet convolutional neural network.	System is not time efficient as it used a combination of two technologies.
Smart Attendance Monitoring System (SAMS)	Viola & Jones image classification algorithm	The system is efficient as compared to manual methods as it is compact, and automatically creates records into database.	System crashes when a greater number of faces are detected, and needs proper light and facial expression for detection.
Class Attendance Management System Using Face Recognition	Local Binary Patterns algorithm (LBP)	The system focuses on accuracy of detection and the ease of performance.	System requires significantly more hardware.
Human face detection algorithm via Haar cascade classifier combined with three additional classifiers	Haar cascade classifier	The system focuses on accuracy of detection which is about 99.9%.	System requires proper internet and database management methods.
FaceTime - Deep Learning Based Face Recognition Attendance System	Convolutional Neural Network (CNN) and CNN cascade	This system gives accuracy of 95.02% using Convolution Neural Networks This system can be used for monitoring purpose.	System uses more time for detecting face, and cannot perform well if internet is fluctuating.

2.1 LITERATURE REVIEW

We have considered the following papers to come up with our project namely:

1. **Attendance Management Using Facial Recognition**
   Rajath S Bharadwaj, Tejus S Rao, Vinay T R
   International Journal of Innovative Technology and Exploring Engineering (IJITEE) ISSN: 2278-3075, Volume-8 Issue-6, April 2019
   Description: Facial recognition technologies have undergone largescale upgrades in performance in the last decade and such systems are now popular in fields such as security and commerce. This work details a real-time automated attendance system which will mark attendance of students and employees alike. The proposed system is a real-world solution to handle day-day activities of an organization such as a college. The main task is using Principle Component Analysis in recognizing the faces of the detected person with high accuracy. The automated system maintains the attendance records of student as manual management of ledgers is a very tedious task. The system enrols the subject's face into the database against the subject's ID (unique) and name. The system then allots attendance to the recognized faces in the database.[1]

2. **Design of Intelligent Classroom Attendance System Based on Face Recognition**
   Wenxian Zeng, Qinglin Meng, Ran Li
   2019 IEEE 3rd Information Technology, Networking, Electronic and Automation Control Conference (ITNEC 2019)
   Description: This paper first introduces the overall design idea of the intelligent classroom attendance system, and then improves the AlexNet convolutional neural network. What's more, we verified the necessity and effectiveness of the improvement from multiple angles, then introduces the application of RFID in the system. Finally, the function and description of the back-end attendance management system are carried out. The experiment proves that the smart classroom attendance system based on face recognition technology is efficient and stable, which effectively reduces the classroom attendance cost.[2]

3. **Smart Attendance Monitoring System (SAMS):**

   A Face Recognition based Attendance System for Classroom Environment

   Shubhobrata Bhattacharya, Gowtham Sandeep Nainala, Prosenjit Das and Aurobinda Routray

   2018 IEEE 18th International Conference on Advanced Learning Technologies

   Description: An automatic attendance management system aims at solving the issues of manual methods of existing systems. We have used the concept of face recognition to implement a system that marks the attendance of a particular person by detecting and recognizing the face. These systems perform satisfactorily with different facial expressions, lighting and pose of the person. There is room for improvement since these systems sometimes fail to recognize every face student present in the classroom. We have made the device portable for easy use even when the sessions are on, without disturbing the class.[3]

4. **Class Attendance Management System Using Face Recognition Omar Abdul Rhman Salim. Rashidah Funke Olanrewaju, Wasiu Adebayo Balogun Department of Electrical and Computer Engineering, Faculty of Engineering International Islamic University Malaysia, Kuala Lumpur**

   Description: The IoT, image processing, and machine learning are evolving day by day. Many systems have been completely changed due to this evolve to achieve more accurate results. The attendance system is a typical example of this transition, starting from the traditional signature on a paper sheet to face recognition. This paper proposes a method of developing a comprehensive embedded class attendance system using facial recognition with controlling the door access. The system is based on Raspberry Pi that runs Raspbian (Linux) Operating System installed on micro SD card. The Raspberry Pi Camera, as well as a 5-inch screen, are connected to the Raspberry Pi. By facing the camera, the camera will capture the image then pass it to the Raspberry Pi which is programmed to handle the face recognition by implementing the Local Binary Patterns algorithm LBPs.[4]

5. **Human face detection algorithm via Haar cascade classifier combined with three additional classifiers**

   Li Cuimei, Qi Zhiliang, Jia Nan, Wu Jianhua

   2017 IEEE 13th International Conference on Electronic Measurement & Instruments

   Description: A new human face detection algorithm by primitive Haar cascade algorithm combined with three additional weak classifiers, based on skin hue histogram matching, eyes detection and mouth detection, is proposed. First, images of face are processed by a primitive Haar cascade classifier. Secondly, a weak classifier based on face skin hue histogram matching is applied and a majority of non-human faces are removed. Next, another weak classifier based on eyes detection is appended and some residual non-human faces are determined and rejected. Finally, a mouth detection operation is utilized to the remaining non-human faces and the false positive rate is further decreased. With the help of OpenCV, test results on images of people under different occlusions and illuminations and some degree of orientations and rotations, in both training set and test set show that the proposed algorithm is effective and achieves state-of-the-art performance.[5]

6. **FaceTime – Deep Learning Based Face Recognition Attendance System**

   Marko Arsenovic, Srdjan Sladojevic, Andras Anderla, Darko Stefanovic

   IEEE 15th International Symposium on Intelligent Systems and Informatics

   Description: In the interest of recent accomplishments in the development of deep convolutional neural networks (CNNs) for face detection and recognition tasks, a new deep learning based face recognition attendance system is proposed in this paper. This model is composed of several essential steps developed using today's most advanced techniques: CNN cascade for face detection and CNN for generating face embeddings. The primary goal of this research was the practical employment of these state-of-the-art deep learning approaches for face recognition tasks. It is determined that with the smaller number of face images along with the proposed method of augmentation high accuracy can be achieved, 95.02% in overall.[6]

2.2 EXISTING SYSTEM

1. Attendance signed manually:

Traditionally, staff / employees mark their attendance by writing their name and signing in the attendance register.

2. Computer based attendance system:

By using computer, the employees would maintain the database. The attendance was used to marked by ticking in box in front of their records which is maintained in database.

3. Android based attendance system:

In this, the employee would mark their attendance through application with the help of Bluetooth.

Only the present employees would be to mark as present and staff would maintain the record.

4. Attendance through fingerprint:

In this method the employees would mark the attendance with the help of fingerprints.

A database of fingerprints would be maintained.

DISADVANTAGES OF EXISTING SYSTEM:

- It is time-consuming and laborious for an organization to employ manual attendance methods, and the labour costs are too high.
- Inaccurate records can cost an organization a lot of money and can also violate labour laws, which may result in expensive legal fines. Regulations require that employers keep track of attendance and provide the required compensation to their employees for any extra hours worked.

CHAPTER 3

IMPLEMENTED SYSTEM

IMPLEMENTED SYSTEM

3.1 IMPLEMENTED SYSTEM

The implemented system overcomes the problem of the existing system. This project uses the face recognition technique using the employee records for marking attendance. In the proposed system application is active during working hours of the organization. The camera of the system (Computer application) will be fitted on entrance as such to scan the faces of anyone who enters the office, the application captures the image and sends it to the processing side. The processing part of the application recognizes the face of the employee. Finally, the application marks the employee if he/she is present. If an employee is not recognized by the application i.e., he / she is not present, he / she is marked as absent for the day.

ADVANTAGES OF IMPLEMENTED SYSTEM:

- Humans are prone to error. Automated attendance management systems ensure accurate time records and minimize the inevitable and costly errors with manual data entry. This accurate data thereby helps to provide accurate performance and payroll data.
- Monitoring and managing attendance manually can be a time-consuming, laborious, and expensive affair. It takes time to process paper sheets and time cards, create schedules, authorize leave and overtime, and create payroll manually.
- The time and effort saved combined with data accuracy helps in optimizing the use of resources which lead to increased productivity and improves profits.
- An integrated attendance management system can provide good visibility of all data and can ease the workflow of payrolls, leaves and performance reviews. Notifications/alerts are automated and the manager can approve requests for early departure, overtime, etc., immediately without any specific need for communication.
- Cloud-based attendance management enables real-time tracking and provides automated inputs for payroll processing.

3.2 SYSTEM ARCHITECTURE

The System process can be separated into three working modules. They are face representation, feature extraction and classification. The first and foremost task is modelling a face. The way is face is represented determines the next two steps. The image acquired is transformed to match the positions of images already present. In feature extraction the features of the face are mapped as histograms with gradients and they are stored as binary values. The final step is recognizing a familiar face. The system compares the face seen in the camera with records that are already stored.

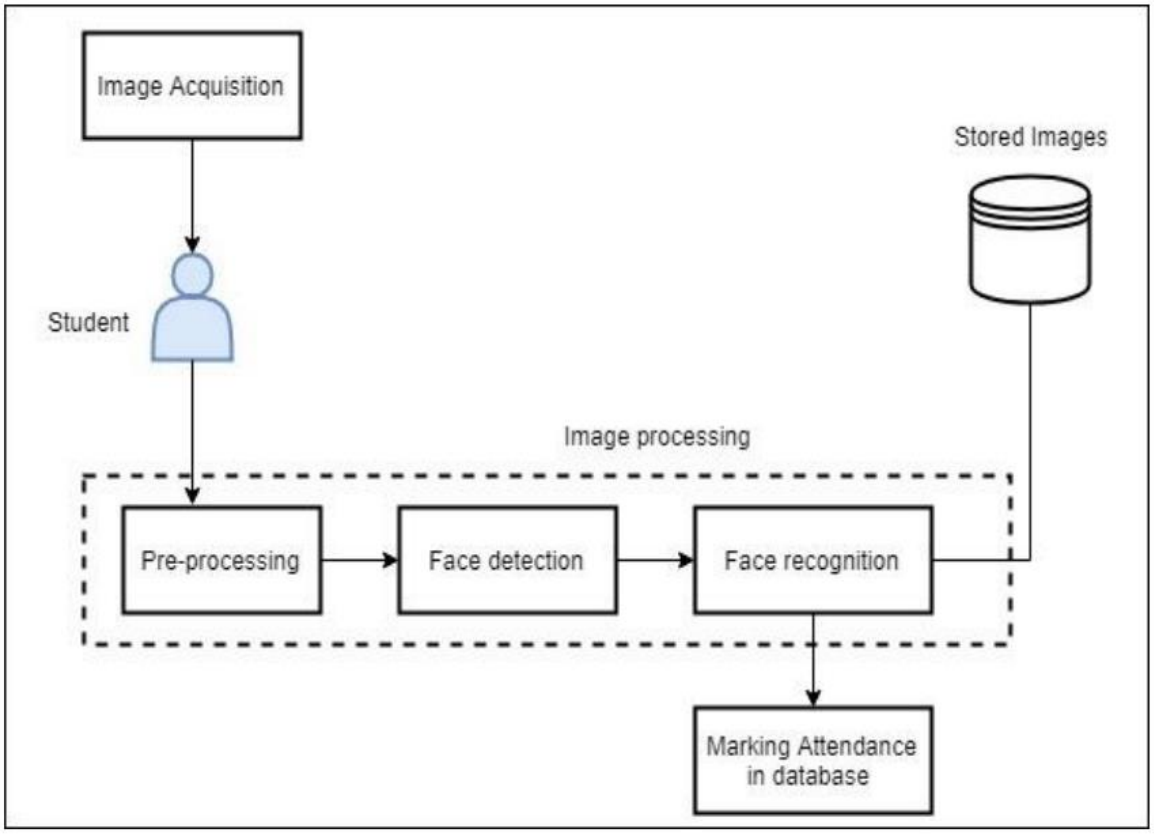


Figure 3.1: System Architecture

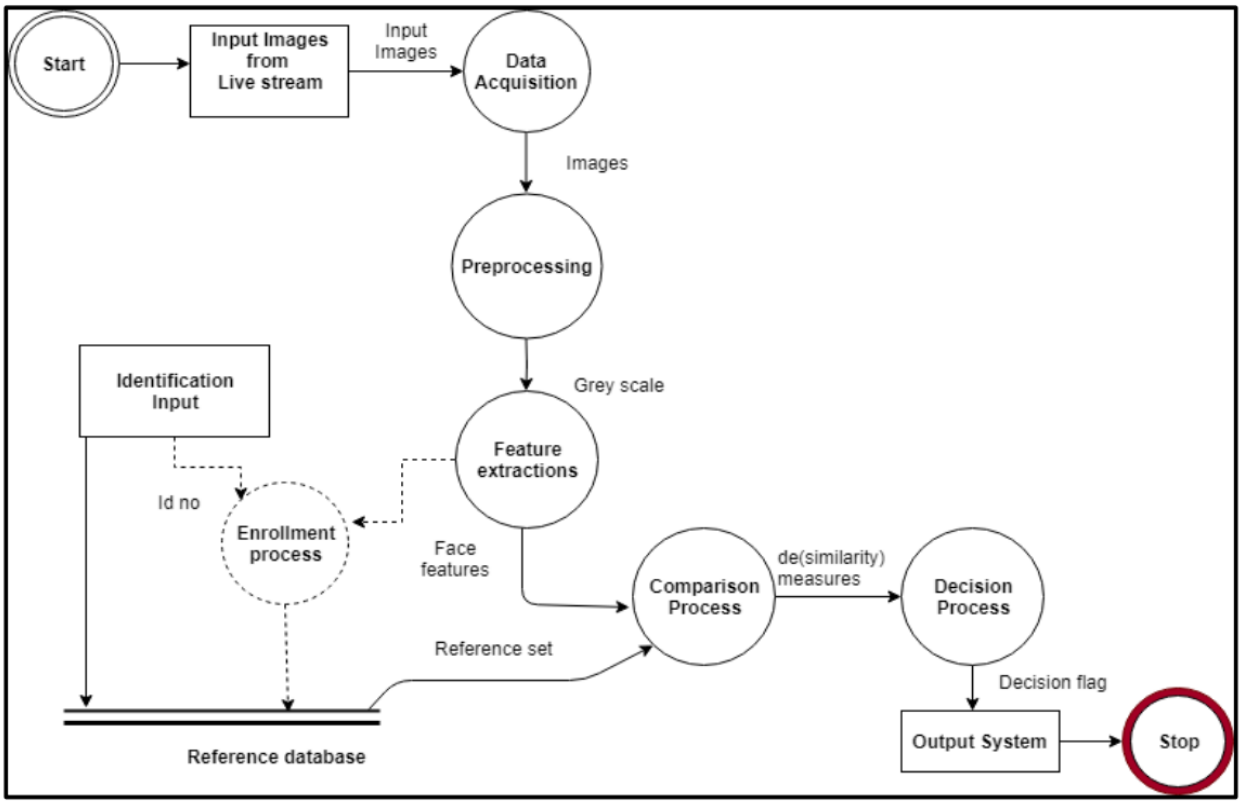


Figure 3.2: Flowchart of Proposed System

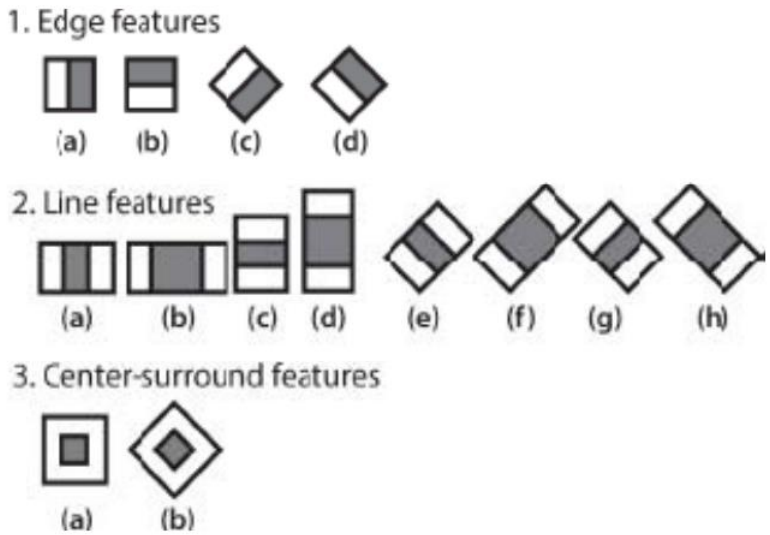


Figure 3.3: Haar-like features from the OpenCV

CHAPTER 4

REQUIREMENT GATHERING & PLANNING

REQUIREMENT GATHERING & PLANNING

4.1 PLANNING & ESTIMATION

A systems development life cycle is composed of a number of clearly defined and distinct work phases which are used by systems engineers and systems developers to plan for, design, build, test, and deliver information systems. Like anything that is manufactured on an assembly line, an SDLC aims to produce high quality systems that meet or exceed customer expectations, based on customer requirements, by delivering systems which move through each clearly defined phase, within scheduled time-frames and cost estimates. Computer systems are complex and often (especially with the recent rise of service-oriented architecture) link multiple traditional systems potentially supplied by different software vendors. To manage this level of complexity, a number of SDLC models or methodologies have been created, and we are using "Agile software development". The system development life cycle framework provides a sequence of activities for system designers and developers to follow. It consists of a set of steps or phases in which each phase of the SDLC uses the results of the previous one. The SDLC adheres to important phases that are essential for developers, such as planning, analysis, design, and implementation, and are explained in the section below. It includes evaluation of present system, information gathering, feasibility study and request approval. These stages can be characterized and divided up in different ways, including the following: -

(a) Preliminary analysis: The objective of phase 1 is to conduct a preliminary analysis, propose alternative solutions, describe costs and benefits and submit a preliminary plan with recommendations.

(b) Systems analysis, requirements definition: Defines project goals into defined functions and operation of the intended application. Analyze end-user information needs.

(c) Systems design: Describes desired features and operations in detail, including screen layouts, business rules, process diagrams, pseudo code and other documentation.

(d) Integration and testing: Brings all the pieces together into a special testing environment, then checks for errors, bugs and interoperability.

(e) Acceptance, installation, deployment: The final stage of initial development, where the software is put into production and runs actual business.

(f) Maintenance: During the maintenance stage of the SDLC, the system is assessed to ensure it does not become obsolete. This is also where changes are made to initial software. It involves continuous evaluation of the system.

4.2 REQUIREMENT ELICITATION

4.2.1 CPU

In computing, a **processor** or processing unit is an electronic circuit which performs operations on some external data source, usually memory or some other data stream.

Pentium is a brand used for a series of x86 architecture-compatible microprocessors produced by Intel since 1993. In their form as of November 2011, Pentium processors are considered entry-level products that Intel rates as "two stars", meaning that they are above the low-end Atom and Celeron series, but below the faster Core i3, i5, i7, i9, and workstation Xeon series.

The G3220 clocks in at a base frequency of 3.00GHz, is a Dual-Core, and has a SmartCache of 3MB. These processors will fit the socket type LGA-1150.

Figure 4.1: Intel Pentium G3220

4.2.2 RAM

Random-access memory (RAM) is a form of computer memory that can be read and changed in any order, typically used to store working data and machine code. A random-access memory device allows data items to be read or written in almost the same amount of time irrespective of the physical location of data inside the memory.

Figure 4.2: HyperX Fury 4GB DDR4 RAM

4.2.3 GPU

A **video card** (also called a display card, graphics card, display adapter, or graphics adapter) is an expansion card which generates a feed of output images to a display device (such as a computer monitor). Frequently, these are advertised as discrete or dedicated graphics cards, emphasizing the distinction between these and integrated graphics. At the core of both is the graphics processing unit (GPU), which is the main part that does the actual computations, but should not be confused with the video card as a whole, although "GPU" is often used to refer to video cards.

Figure 4.3: ZOTAC GeForce GT 1030 Graphics Card

4.2.4 HDD

A **hard disk drive** (HDD), hard disk, hard drive, or fixed disk is an electro-mechanical data storage device that uses magnetic storage to store and retrieve digital information using one or more rigid rapidly rotating disks (platters) coated with magnetic material. Data is accessed in a random-access manner, meaning that individual blocks of data can be stored or retrieved in any order and not only sequentially. HDDs are a type of non-volatile storage, retaining stored data even when powered off.

Figure 4.4: Western Digital Blue 7200 RPM Hard Disk

Figure 4.5: INTEX IT-306 PC Webcam

4.2.5 WEBCAM

A **webcam** is a video camera that feeds or streams an image or video in real time to or through a computer to a computer network, such as the Internet. Webcams are typically small cameras that sit on a desk, attach to a user's monitor, or are built into the hardware.

4.2.6 WINDOWS

Microsoft Windows, commonly referred to as **Windows**, is a group of several proprietary graphical operating system families, all of which are developed and marketed by Microsoft.

Figure 4.6: Windows Logo

4.2.7 PYTHON

Python is a high-level, general-purpose programming language with a reference implementation that compiles source code into bytecode before being executed on a process virtual machine.

Figure 4.7: Python Logo

4.2.8 PYCHARM

PyCharm is an integrated development environment (IDE) used in computer programming, specifically for the Python language. It is developed by the Czech company JetBrains.

Figure 4.8: PyCharm Logo

4.3 REQUIREMENT ANALYSIS

4.3.1 HARDWARE REQUIREMENTS

1. Dual Core 2 GHz Intel Pentium or any equivalent processor.
2. 4GB System RAM.
3. DirectX 9 compatible NVIDIA or AMD video card with 1GB of VRAM.
4. 10 GB free hard disk space.
5. Web Camera
6. External mouse and keyboards

4.3.2 SOFTWARE REQUIREMENTS

1. OS: Windows 7/8.1/10
2. Language: Python 3
3. IDE: JetBrains PyCharm

4.4 FEASIBILITY STUDY

In simple terms, a feasibility study involves taking a judgment call on whether a project is doable. The two criteria to judge feasibility are cost required and value to be delivered. A well – designed study should offer a historical background of the business or project, a description of the product or service, accounting statements, details of operations and management, marketing research and policies, financial data, legal requirements and tax obligations. Generally, such studies precede technical development and project implementation.

4.4.1 TECHNICAL FEASIBILITY

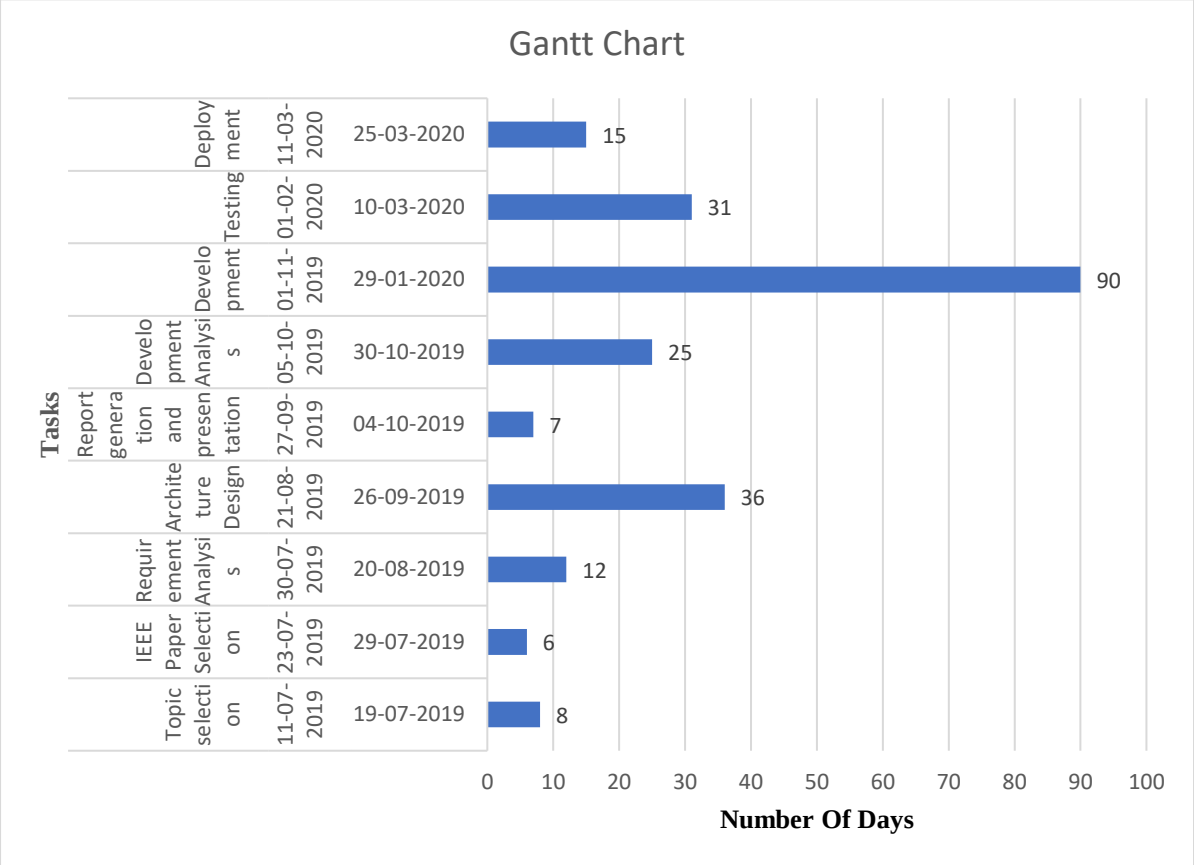
We concern here with specifying Equipment and software that will satisfy the user requirement. It will run with minimum system requirements and with minimum system resources acquired during run. It will need a web server, to which it gets from the internet, at run time. Expandability will be maintained in the new system. New modules can be added later on, the application, if required in the future.

4.4.2 ECONOMIC FEASIBILITY

The procedure is to determine the benefit and savings that are expected from the project and compare them with the cost. As internet is the cheapest way of communication, we can perform communication using web. The cost is just the cost of using the internet based on the channel allocation. So, the project will be economically feasible**.**

4.5 GANTT CHART

A Gantt chart is a horizontal bar chart developed as a production control tool in 1917 by Henry L. Gantt, an American engineer and social scientist. Frequently used in project management, a Gantt chart provides a graphical illustration of a schedule that helps to plan, coordinate, and track specific tasks in a project.



CHAPTER 5
PROJECT DESIGN

5.1 DATA FLOW DIAGRAM

A data flow diagram (DFD) is a graphical representation of the "flow" of data through an information system, modelling its process aspects. ADFD is often used as a preliminary step to create an overview of the system without going into great detail, which can later be elaborated.

Figure 5.1.1: Data Flow Diagram (Level 0)

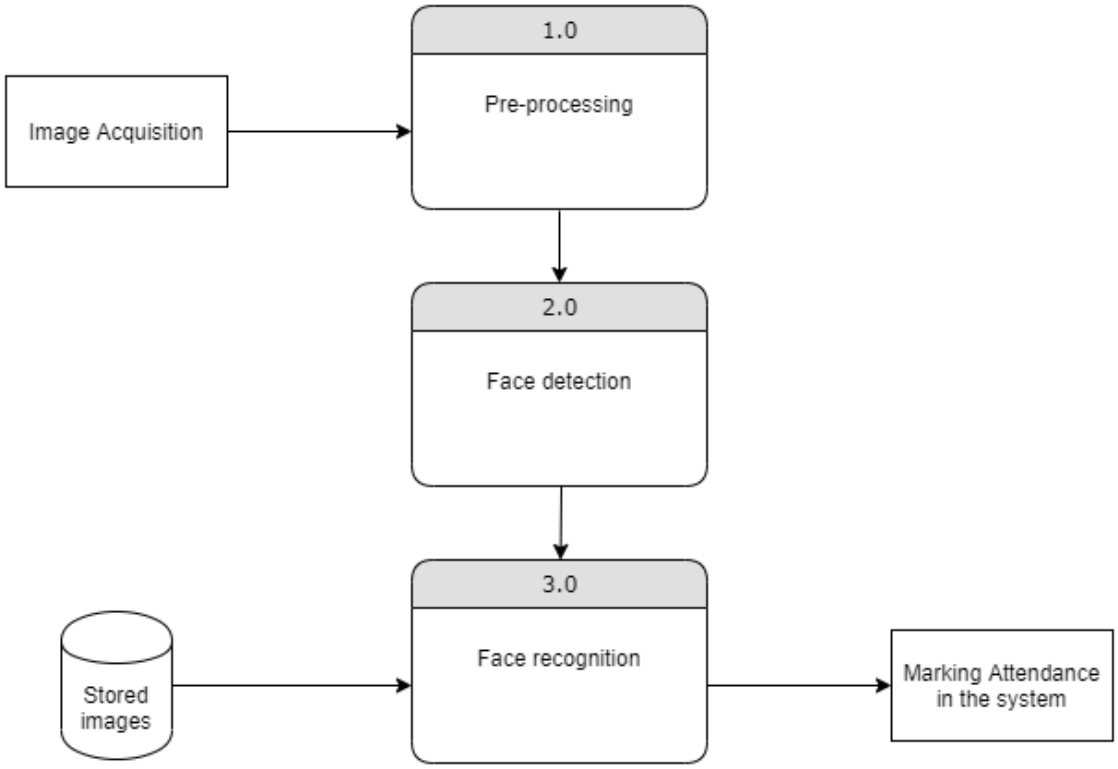


Figure 5.1.2: Data Flow Diagram (Level 1)

5.2 SEQUENCE DIAGRAM

Sequence diagrams are sometimes called event diagrams or event scenarios. A sequence diagram shows, as parallel vertical lines (lifelines), different processes or objects that live simultaneously, and, as horizontal arrows, the messages exchanged between them, in the order in which they occur.

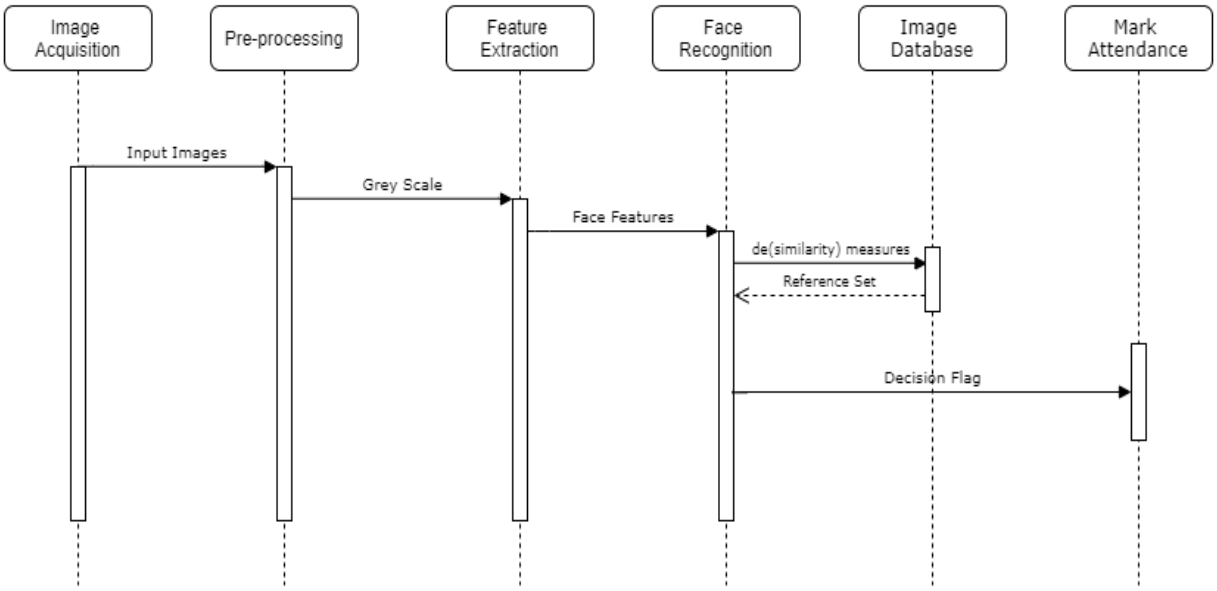


Figure 5.2: Sequence Diagram

5.3 USE CASE DIAGRAM

A use case is a list of actions or event steps typically defining the interactions between a role (known in the Unified Modelling Language as an actor) and a system to achieve a goal. The actor can be a human or other external system. The actor can be a human or other external system. An actor in the Unified Modelling Language specifies a role played by a user or any other system that interacts with the subject." "An Actor models a type of role played by an entity that interacts with the subject, but which is external to the subject.

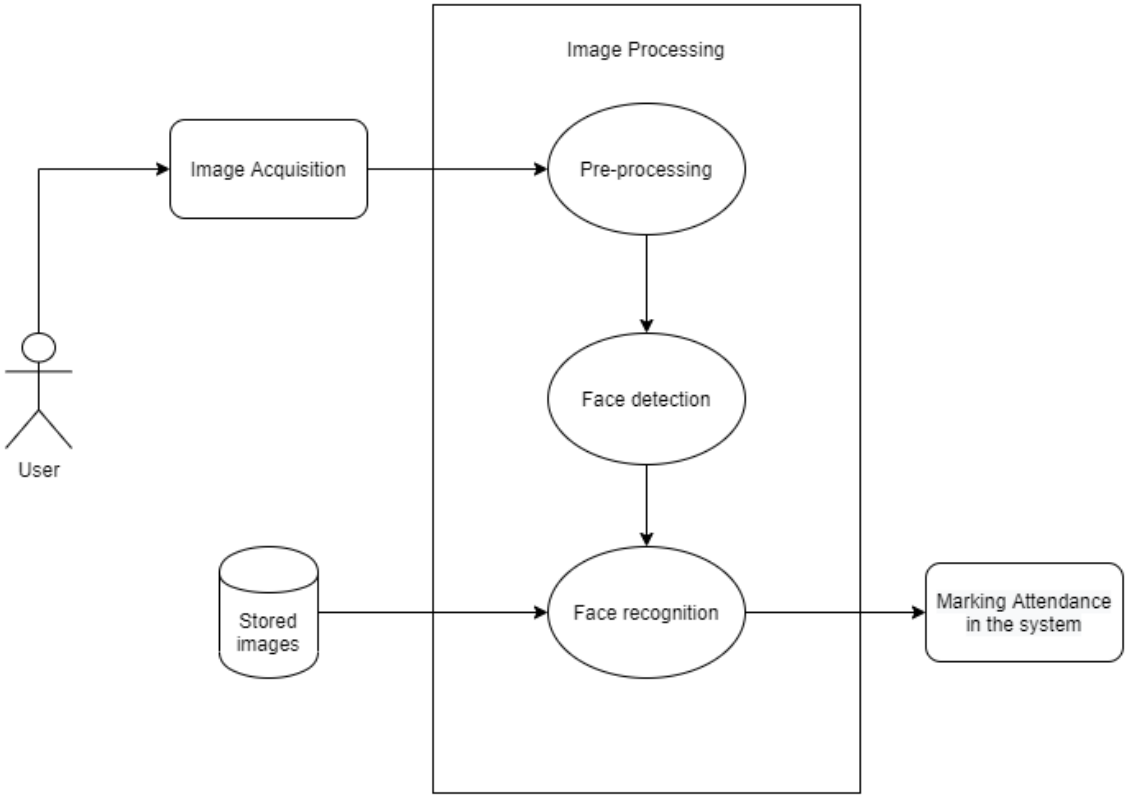


Figure 5.3: Use Case Diagram

5.4 CLASS DIAGRAM

A class diagram in the Unified Modelling Language (UML) is a type of static structure diagram that describes the structure of a system by showing the system's classes, their attributes, operations (or methods), and the relationships among objects.

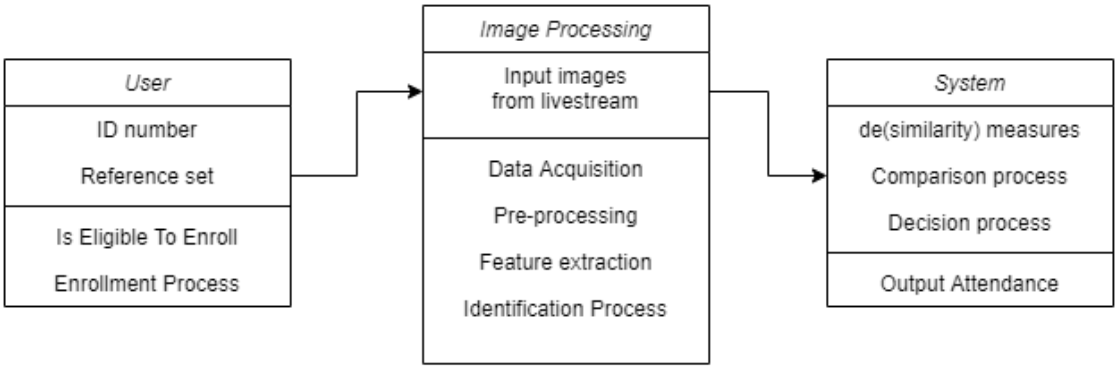


Figure 5.4: Class Diagram

5.5 ACTIVITY DIAGRAM

Activity diagram is another important diagram in UML to describe the dynamic aspects of the system. Activity diagram is basically a flowchart to represent the flow from one activity to another activity. The activity can be described as an operation of the system. The control flow is drawn from one operation to another.

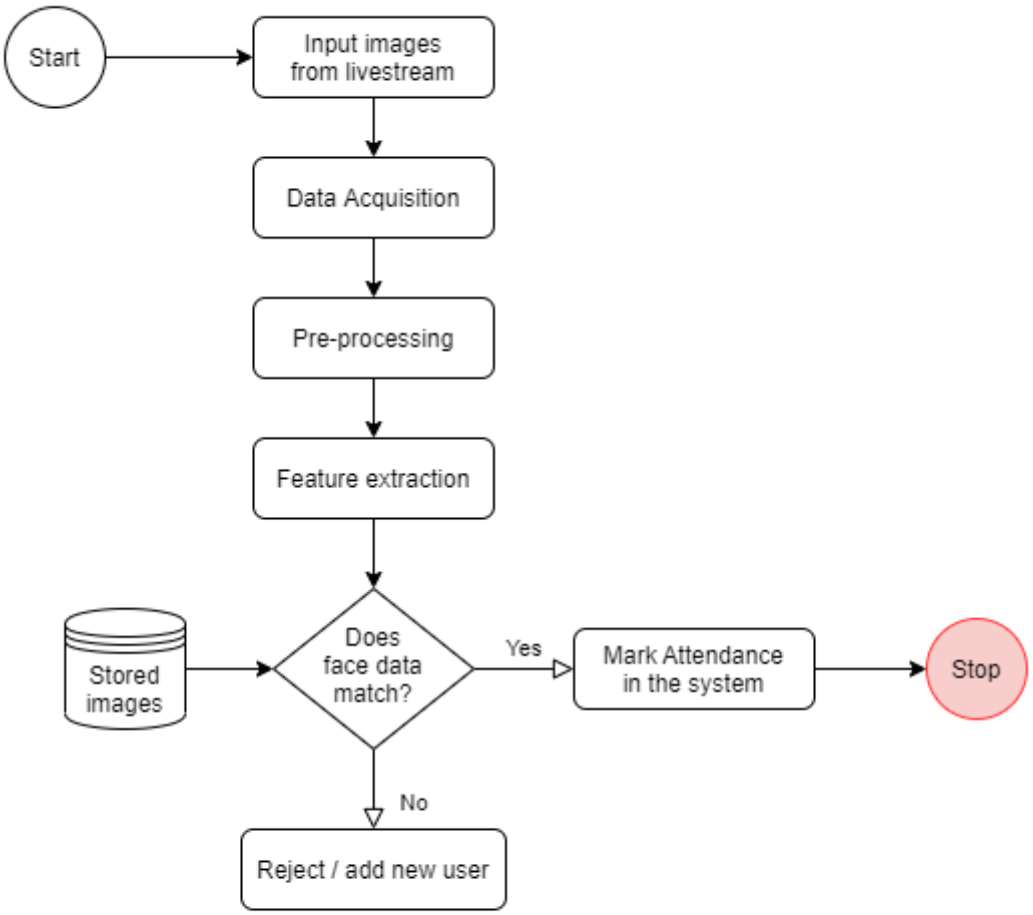


Figure 5.5: Activity Diagram

5.6 COMPONENT DIAGRAM

It does not describe the functionality of the system but it describes the components used to make those functionalities.

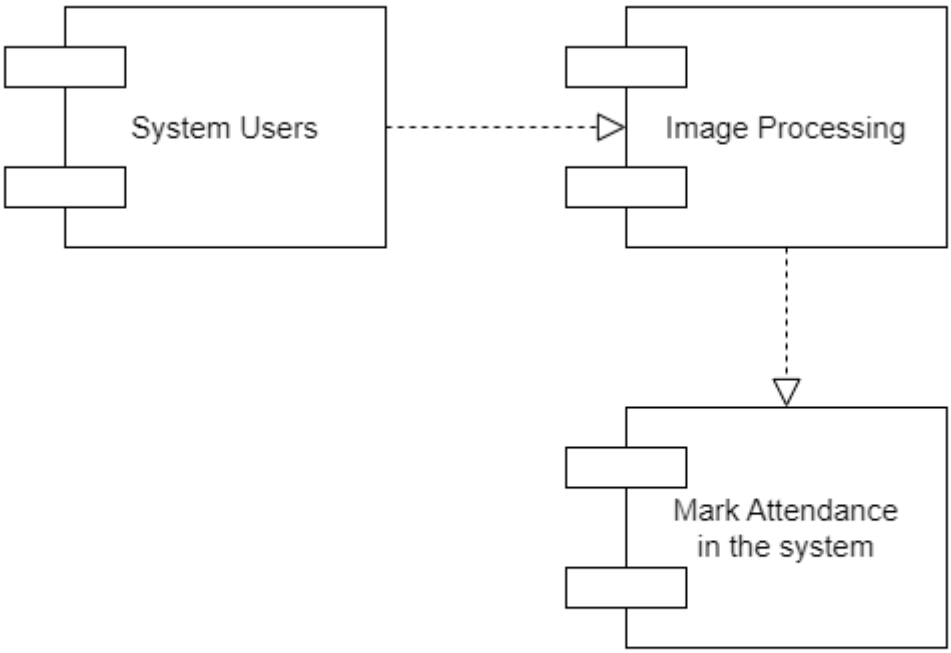


Figure 5.6: Component Diagram

CHAPTER 6
RESULT ANALYSIS

6.1 SCREENSHOTS

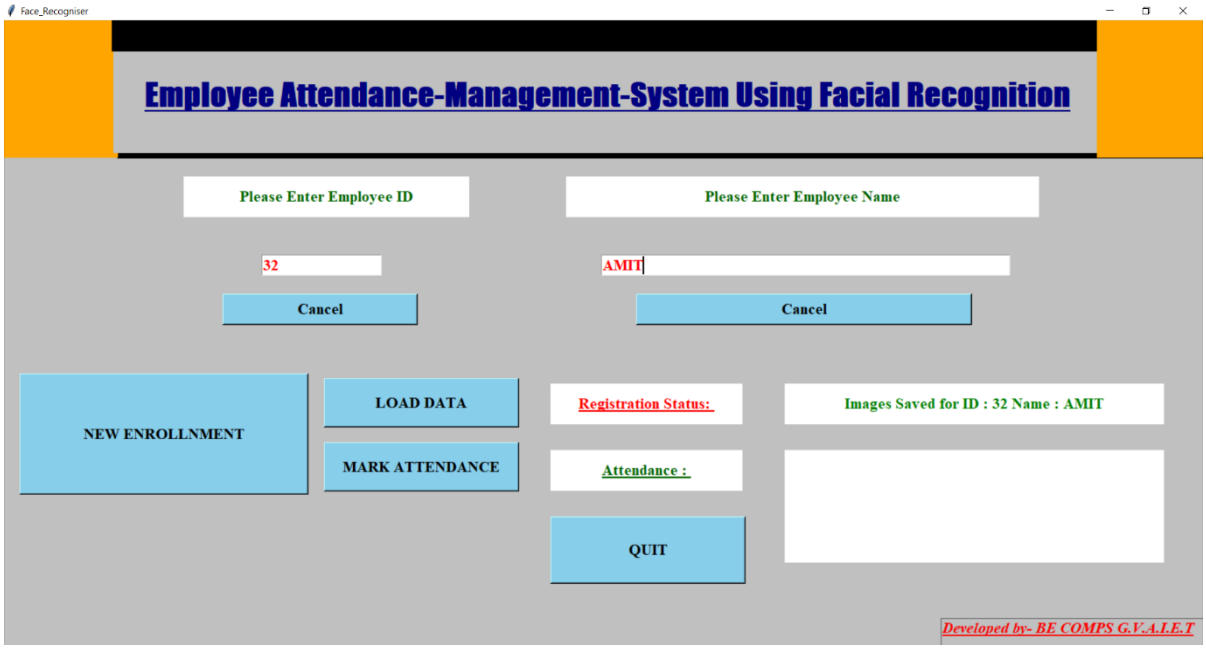


Figure 6.1: Home UI screen

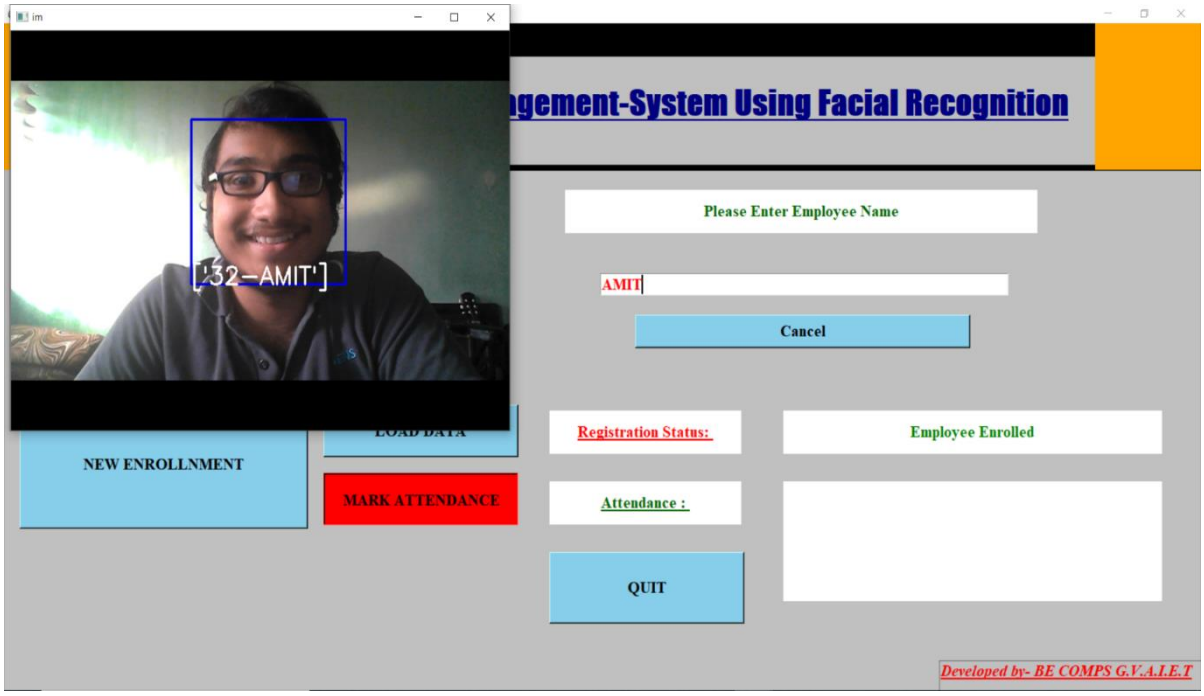


Figure 6.2: Face Recognition screen

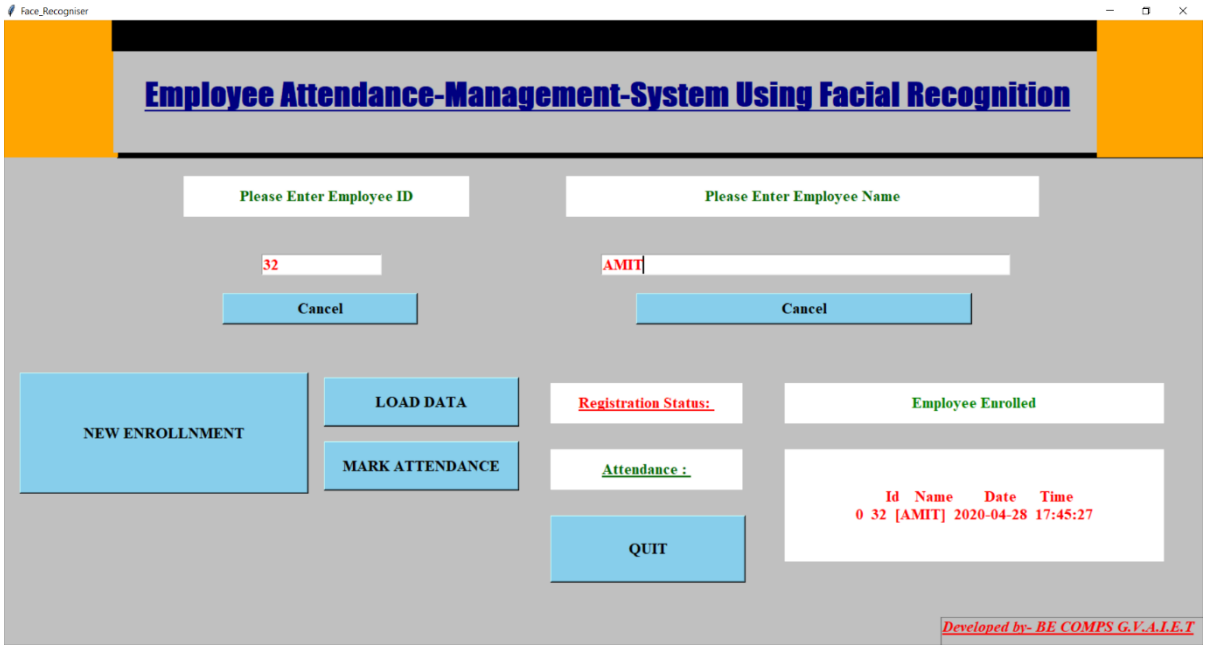


Figure 6.3: Attendance marked screen

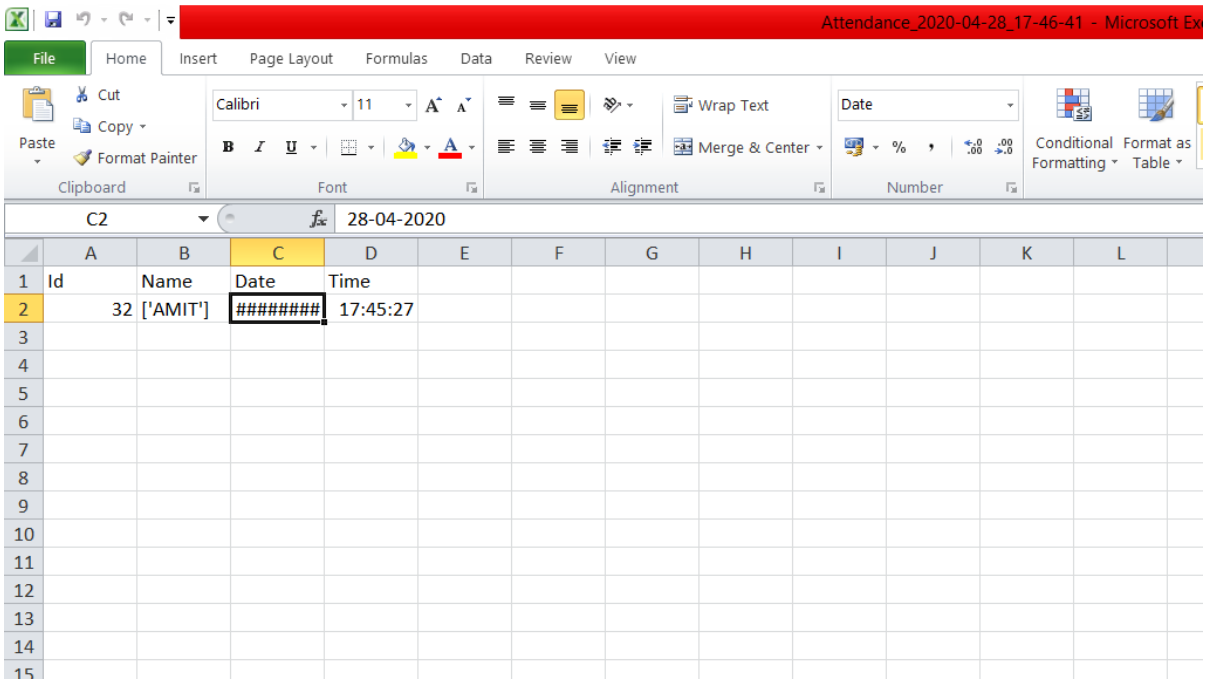


Figure 6.4: Stored Attendance records

CHAPTER 7
SOFTWARE TESTING

SOFTWARE TESTING

7.1 SOFTWARE TESTING

Software testing is an investigation conducted to provide stakeholders with information about the quality of the software product or service under test.[1] Software testing can also provide an objective, independent view of the software to allow the business to appreciate and understand the risks of software implementation. Test techniques include the process of executing a program or application with the intent of finding software bugs (errors or other defects) and verifying that the software product is fit for use.

Software testing involves the execution of a software component or system component to evaluate one or more properties of interest. In general, these properties indicate the extent to which the component or system under test

- Meets the requirements that guided its design and development,
- Responds correctly to all kinds of inputs,
- Performs its functions within an acceptable time,
- Is sufficiently usable,
- Can be installed and run in its intended environments, and
- Achieves the general result its stakeholder's desire.

As the number of possible tests for even simple software components is practically infinite, all software testing uses some strategy to select tests that are feasible for the available time and resources. As a result, software testing typically (but not exclusively) attempts to execute a program or application with the intent of finding software bugs (errors or other defects). The job of testing is an iterative process as when one bug is fixed; it can illuminate other, deeper bugs, or can even create new ones.

Software testing can provide objective, independent information about the quality of software and risk of its failure to users or sponsors.

Software testing can be conducted as soon as executable software (even if partially complete) exists. The overall approach to software development often determines when and how testing is conducted. For example, in a phased process, most testing occurs after system requirements have been defined and then implemented in testable programs. In contrast, under an agile approach, requirements, programming, and testing are often done concurrently.

7.1.1 SYSTEM TESTING

System testing of software or hardware is testing conducted on a complete, integrated system to evaluate the system's compliance with its specified requirements. System testing falls within the scope of black-box testing, and as such, should require no knowledge of the inner design of the code or logic.

As a rule, system testing takes, as its input, all of the "integrated" software components that have passed integration testing and also the software system itself integrated with any applicable hardware system(s). The purpose of integration testing is to detect any inconsistencies between the software units that are integrated together (called assemblages) or between any of the assemblages and the hardware. System testing is a more limited type of testing; it seeks to detect defects both within the "inter-assemblages" and also within the system as a whole.

7.1.2 UNIT TESTING

Unit Testing is a software testing method by which individual units of source code, sets of one or more computer program modules together with associated control data, usage procedures, and operating procedures, are tested to determine whether they are fit for use. Intuitively, one can view a unit as the smallest testable part of an application. In procedural programming, a unit could be an entire module, but it is more commonly an individual function or procedure. In object-oriented programming, a unit is often an entire interface, such as a class, but could be an individual method.

Unit tests are short code fragments created by programmers or occasionally by white box testers during the development process. It forms the basis for component testing. Ideally, each test case is independent from the others. Substitutes such as method stubs, mock objects, fakes, and test harnesses can be used to assist testing a module in isolation. Unit tests are typically written and run by software developers to ensure that code meets its design and behaves as intended.

7.1.3 INTEGRATION TESTING

Integration testing (sometimes called integration and testing, abbreviated I&T) is the phase in software testing in which individual software modules are combined and tested as a group. It occurs after unit testing and before validation testing. Integration testing takes as its input modules that have been unit tested, groups them in larger aggregates, applies tests defined in an integration test plan to those aggregates, and delivers as its output the integrated system ready for system testing.

7.1.4 FUNCTIONAL TESTING

Functional testing is a quality assurance (QA) process and a type of black-box testing that bases its test cases on the specifications of the software component under test. Functions are tested by feeding them input and examining the output, and internal program structure is rarely considered Functional testing usually describes what the system does.

Functional testing does not imply that you are testing a function (method) of your module or class. Functional testing tests a slice of functionality of the whole system.

Function testing is centred on the following items:

Valid Input: Identified classes of valid input must be accepted.

Invalid Input: Identified classes of invalid input must be rejected.

Functions: Identified functions must be exercised.

Output: Identified classes of application outputs must be exercised.

Procedures: Interfacing system or procedures must be invoked.

7.2 TESTING METHODS

7.2.1 BLACK BOX TESTING

Black-box testing treats the software as a "black box", examining functionality without any knowledge of internal implementation, without seeing the source code. The testers are only aware of what the software is supposed to do, not how it does it.[15] Black-box testing methods include: equivalence partitioning, boundary value analysis, all-pairs testing, state transition tables, decision table testing, fuzz testing, model-based testing, use case testing, exploratory testing, and specification-based testing.

Specification-based testing aims to test the functionality of software according to the applicable requirements.[16] This level of testing usually requires thorough test cases to be provided to the tester, who then can simply verify that for a given input, the output value (or behaviour), either "is" or "is not" the same as the expected value specified in the test case. Test cases are built around specifications and requirements, i.e., what the application is supposed to do. It uses external descriptions of the software, including specifications, requirements, and designs to derive test cases. These tests can be functional or non-functional, though usually functional.

7.2.2 WHITE BOX TESTING

White-box testing (also known as clear box testing, glass box testing, and transparent box testing and structural testing, by seeing the source code) tests internal structures or workings of a program, as opposed to the functionality exposed to the end-user. In white-box testing, internal perspectives of the system, as well as programming skills, are used to design test cases.

The tester chooses inputs to exercise paths through the code and determine the appropriate outputs. While white-box testing can be applied at the unit, integration and system levels of the software testing process, it is usually done at the unit level. It can test paths within a unit, paths between units during integration, and between subsystems during a system–level test. Though this method of test design can uncover many errors or problems, it might not detect unimplemented parts of the specification or missing requirements.

7.3 TEST CASES

Test Case Name: Camera Test

Purpose	Captures continuous video
Description	A pre-installed Camera e.g. Webcam, CCTV
Test data	1. Whether camera shoots footage 2. Check if it captures user faces
Steps	Make connection to other system and capturing Data
Expected Output	Show capturing data
Remark	Successful

Test Case Name: Attendance Test

Purpose	Camera connects to system and detect faces of users
Description	A computer connected to the camera
Test data	1. Coding is uploaded 2. Check code didn't give any error. 3. Run the code
Steps	1. Connect to camera 2. Enable face extraction module 3. Recognize and check with stored faces 4. Mark Attendance
Expected Output	Detects ID and marks attendance
Remark	Successful

CHAPTER 8
CONCLUSION

CONCLUSION

5.1 CONCLUSION

A new human face detection algorithm is proposed on a basis of cascade classifiers using Haar-like features. Three additional weak classifiers are subsequently appended to the primitive Haar-like features based cascaded classifiers. One is a decision node based on human skin hue histogram matching. The second and the third weak classifiers are based on eyes and mouth detections, respectively. Because eyes and mouth detections are also implemented with Haar-like features-based cascade classifiers, both of them have a sufficiently high detection rate, satisfying conditions of weak classifiers. Experimental results show that the proposed human detection algorithm compensates the shortcomings of the primitive Viola-Jones' cascade classifier and makes the whole human face detection rate higher while keeping nearly zero wrong rejection.

The contributions of this work can be concluded as below:

(1) A weak classifier based on human face skin tone histogram can reject a big proportion of non-faces wrongly detected by the primitive Viola-Jones' Haar-like features-based cascade classifiers.

(2) 2 additional classifiers based on eyes and mouth detections further remove those non-faces whose colors happen to be in accordance with the human skin color, but there are probably no eyes- and mouth-like objects in it.

(3) The proposed human face detection system is simple to implement due to availability of modules in OpenCV.

5.2 FUTURE SCOPE

In future, more research work should continually focus on human face detection for people of different races, instead of faces of single race as in our work. Computation time should also be further saved for real world applications.

CHAPTER 9

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Automated Attendance System Using Facial Recognition

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Abstract - *Facial recognition technologies have undergone large-scale upgrades and with the new human based facial recognition algorithm named as 'Haar-cascade' [5] which is used with the three classifiers that are skin classifier, mouth classifier & eyes classifier [5]. This proposed system works in real-time as automated attendance system which marks the attendance of employees in an organization. The proposed system uses the algorithm of 'Haar-cascade' [5] with three classifiers implemented using python's 'Open-CV library' [5] and this system uses Principle Component Analysis [PCA] [1] in order to maintain the accuracy of the facial detection.. This proposed system requires less hardware support also the processing time is also less in compare to other conventional system of signing papers, Radio Frequency Identification [RFID] [2] and biometrics [4] which proves this system to be more efficient for organization to use it in real time application.*

Key Words: **Open-CV; Computer Vision; CNN; PCA; LBP; human face detection; Haar-like features; face skin hue histogram match; eyes detection; mouth detection; cascade classifier**

1. INTRODUCTION

This project presents the development and implementation of Smart Attendance System. Our system is designed in such a way that it manages the employee attendance record in a very efficient manner & time saving pattern that the employee doesn't require to fill the attendance sheet or put a thumb for biometric way or scanning Radio Frequency Identification [RFID][6] cards instead the Automated Attendance System concerns about the employee efforts and doesn't disturb his work and secretly captures the record of his/her presence at the time of employee visiting towards gate and exiting the gate and the record is stored into the database and which contributes hassle free and costless attendance of employee. This cost-saving and time-saving system results a huge profit for organization due to its efficiency. Our attempt is to develop and implement a Smart Attendance System for organization in hassle free manner just by facial detection using Haar-cascade algorithm [1] with classifier based on skin hue histogram matching, eyes detection and mouth detection. The organization has to just place our Automated Attendance System in the entry gate and exit gate of the working area of the employees. Whenever the employee will just pass through the gate and automatically our system will capture his face while during entry period and exit period and it will store that record into the database.

2. LITERATURE REVIEW

Our proposed system is produced by following all the previous gadgets and methods for marking and noting down the attendance. First model we referred was from the paper- "Attendance Management Using Facial Recognition" from this paper we note that the technologies used in this system was Principle Component Analysis(PCA), in this system we found that the accuracy is high and less processing time but it has difficulties to maintain database and it requires continues power-supply. The second thesis we referred was "Design of Intelligent Classroom Attendance System Based on Face Recognition" in this the technologies used were AlexNet Convolution Neural Network combined with RFID, the system was accurate to launch CNN but it wasn't efficient. Third thesis we referred was "Smart Attendance Monitoring System", in this technology we found that the Viola & Jones image classification algorithm was used and the results were it was accurate and compact but it doesn't work in areas where there is insufficient light and also it crashes when more entries are made into the database. Fourth paper we referred was "Class Attendance Management System Using Face Recognition" in this paper the technologies used were Local Binary Patterns algorithm(LBP) but it also requires more hardware components. The next system we referred from thesis "FaceTime- Deep Learning Based Face Recognition Attendance System" from this system we studied that the technologies used were Convolution Neural Network and CNN cascade, the result it gives is accuracy of 95.02% with monitoring feature but it takes more time for its functioning and also fails when there is not stable internet connectivity. We developed system which removes almost all the delimitation of referred systems as we use Haar cascade algorithm with three classifiers and it detects and marks attendance using face using minimal time & hardware equipment.

3. PROPOSED SYSTEM

The Proposed system overcomes the problem of the existing system. This project uses the face recognition technique using the employee records for marking attendance. In the proposed system application is active during working hours of the organization. The camera of the system (Computer application) will be fitted on entrance as such to scan the faces of anyone who enters the office, the application captures the image and sends it to the processing side. The processing part of the application recognizes the face of the employee. Finally, the application marks the employee if he/she is present. If an employee is not recognized by the application i.e., he / she is not present, he / she is marked as absent for the day. Humans are prone to error. Automated attendance management systems ensure accurate time records and minimize the inevitable and costly errors with manual data entry. This accurate data thereby helps to provide accurate performance and payroll data.

Proposed System has the following Significance-

- Monitoring and managing attendance manually can be a time-consuming, laborious, and expensive affair. It takes time to process paper sheets and time cards, create schedules, authorize leave and overtime, and create payroll manually.
- The time and effort saved combined with data accuracy helps in optimizing the use of resources which lead to increased productivity and improves profits.
- An integrated attendance management system can provide good visibility of all data and can ease the workflow of payrolls, leaves and performance reviews. Notifications/alerts are automated and the manager can approve requests for early departure, overtime, etc., immediately without any specific need for communication.
- Cloud-based attendance management enables real-time tracking and provides automated inputs for payroll processing.

4. SYSTEM ARCHITECTURE

The System process can be separated into three working modules. They are face representation, feature extraction and classification. The first and foremost task is modeling a face. The way is face is represented determines the next two steps. The image acquired is transformed to match the positions of images already present. In feature extraction the features of the face are mapped as histograms with gradients and they are stored as binary values. The final step is recognizing a familiar face. The system compares the face seen in the camera with records that are already stored.

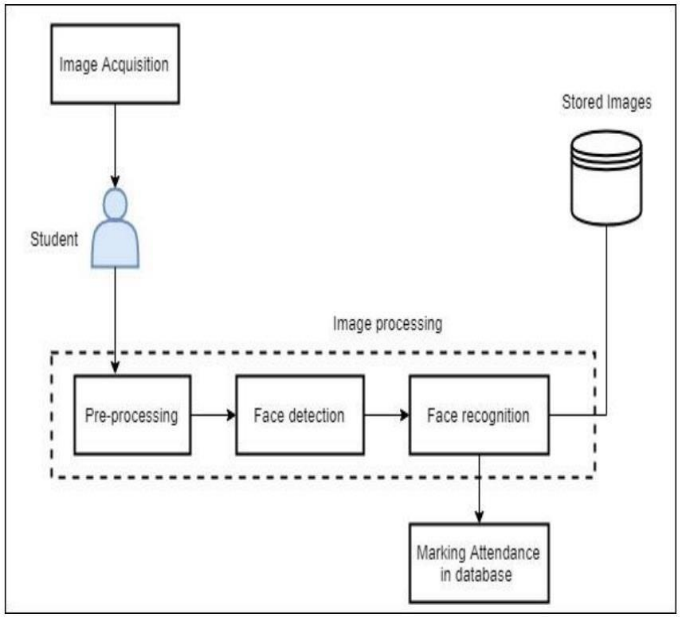

Fig 4.1 -: System Architecture

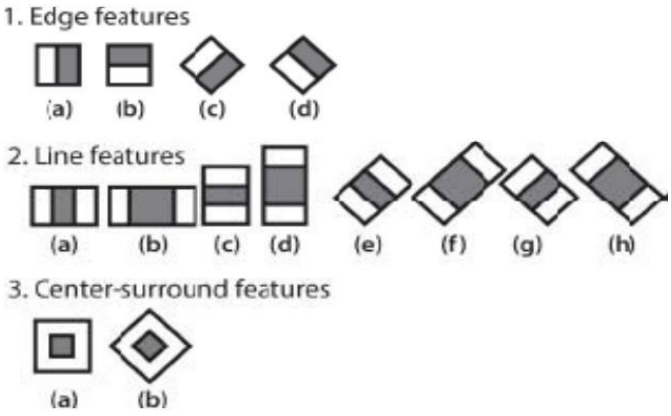

Fig 4.2 -: Haar like features from OpenCv

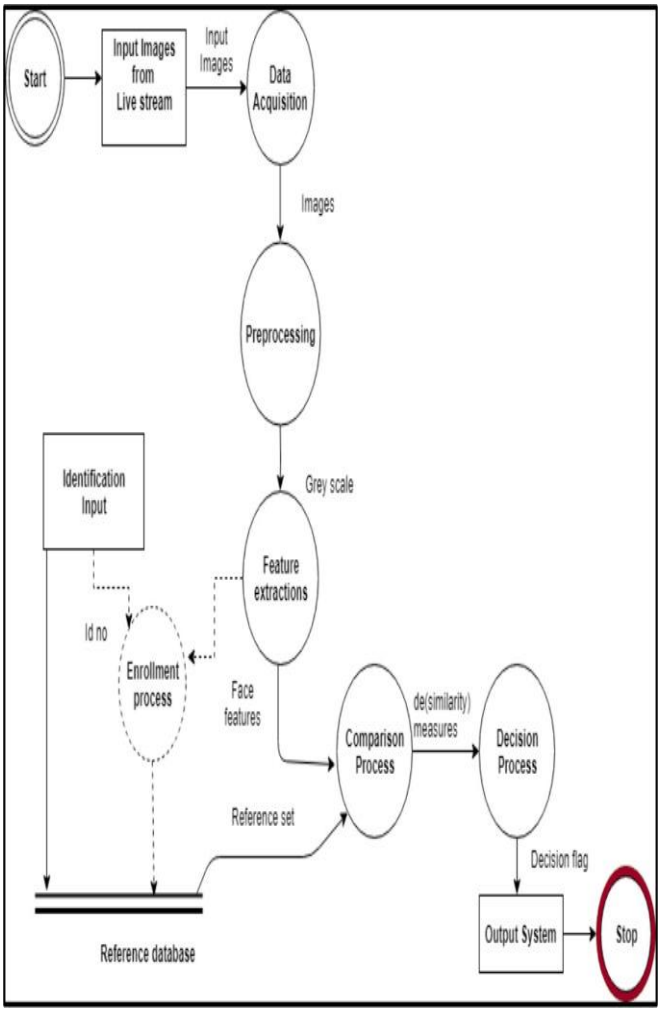

Fig -4.3: Flowchart of Proposed System

5. CONCLUSIONS

A new human face detection algorithm is proposed on a basis of cascade classifiers using Haar-like features. Three additional weak classifiers are subsequently appended to the primitive Haar-like features based cascaded classifiers. One is a decision node based on human skin hue histogram matching. The second and the third weak classifiers are based on eyes and mouth detections, respectively. Because eyes and mouth detections are also implemented with Haar-like features-based cascade classifiers, both of them have a sufficiently high detection rate, satisfying conditions of weak classifiers. Experimental results show that the proposed human detection algorithm compensates the shortcomings of the primitive Viola-Jones' cascade classifier and makes the whole human face detection rate higher while keeping nearly zero wrong rejection.

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- The proposed human face detection system is simple to implement due to availability of modules in OpenCV.

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